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genus of tall, rigid, umbelliferous plants, peculiar to the islands, with the exception of a rare and feeble species which occurs on the mountains of eastern Australia. The leaves and bracts of two of the species, in all their subdivisions, end in long, rigid spines, rendering them most formidable plants. The only suggested explanation for the occurrence of such strongly-armed species is that they were thus protected against the moas. This may or may not be true. It may be said in favor of the hypothesis that the moas were extraordinarily abundant in former times and they were vegetable feeders, the contents of their crops, consisting of rounded pebbles and comminuted vegetable fibres, being commonly found. It is also the case that since the introduction of pigs into the colony, these plants have been immensely reduced in numbers. The pigs root up the ground at some little distance from the plant, and so get at it from below.

But, leaving this exceptional case, we find the general statement true with which this note is prefaced. A few examples may be given. The genus *Acæna* consists of small rosaceous herbs which have undergone considerable retrogressive development. The name refers to the spines, formed of the four produced and hardened persistent calyx-lobes which project above the fruit. Of the five species found in New Zealand, two have a wide distribution outside the islands; *A. sanguisorbæ* ranging westwards across Tasmania and Australia, and reappearing in Tristan d'Acunha; while *A. adscendens* is a more Antarctic type, occurring in the Macquarrie Islands, Tierra del Fuego, and the Falkland Islands. In both these species the calyx spines are tipped with small barbed hairs, by means of which the fruit adheres to any passing animal with great persistence. In the other species of the genus which are peculiar to New Zealand, the spines have almost or altogether lost the barbs and the fruit is not distributed widely. The change is not, however, complete in all; thus in *A. microphylla* the spines are strongly developed and occasionally have reversed hairs on their summit. In *A. Buchanani* the spines are feeble and rarely have a few apical hairs, but sometimes they are not developed. Lastly, in *A. inermis* the calyx merely has its angles thickened in fruit, and there are no spines.

The only other New Zealand plants in which the fruit is carried by means of barbs which could catch on to passing animals belong to the genus *Uncinia*, a group of sedges which have the utricle furnished with a long barbed bristle or seta. This forms a most efficient organ for hooking hairs, etc., and it renders the fruit a great pest to dogs. The New Zealand species are, as Hooker says, "difficult of discrimination," and some are so closely allied to Tasmanian or to South American forms as to be almost indistinguishable. The genus is widely spread in the Southern Hemisphere, and also occurs as far north as the mountains of Abyssinia. It is clear that the barbed bristle is a character developed outside of these islands and is evidently of great antiquity. In some of the more slender endemic forms it is not very strongly developed, but I know of no species which has lost it.

Spiny and prickly plants are very rare, and, with the exception of the *Aciphyllas* already mentioned, are all Australian. *Discaria toumatou* is probably the same as the Australian *D. australis*; in this plant the leaves are small, and the branches are developed into strong spines which protect it against grazing animals. *Eryngium vesiculosum* is a low-growing umbelliferous plant with very prickly leaves and bracts, but it is a common Australian and Tasmanian species. The same remark applies to *Rubus australis*, but in this case the formidable, recurved prickles, which have earned the plant the name of "bush lawyer," are chiefly of service as climbing organs. There is, indeed, no endemic spiny plant in New Zealand (except *Aciphylla*).

The tendency to lose the protective character is shown in a most instructive manner in a few instances. Thus there are in these islands two species of the myrtaceous genus *Leptospermum*. *L. scoparium*, which is also common in Tasmania, has rigid, pungent leaves, which only an animal with a hard palate could attack with impunity. On the other hand, *L. ericoides*, which is confined to the islands, has quite lost the pungent tip to its leaves, and the foliage and branches are much softer and less rigid.

An exception to the rule here exemplified is afforded by the nettles, of which one endemic species, *Urtica ferox*, is about as

diabolical a species as can be met with. Its long, stinging hairs inflict a painful wound. It is difficult to say what they serve to protect the plant from. As if to show that perfection of protective development in one direction does not always serve in another, it is a fact worth noting that this species is so very much attacked by leaf-eating insects that it is often a matter of difficulty to get herbarium specimens quite perfect.

THE PSYCHOLOGICAL LABORATORY AT YALE.

FOR several years Professor Ladd has been lecturing on physiological psychology, using charts, models, microscope slides, etc., for illustration. His earnest desire to have a laboratory for this science finally met its fulfillment last spring. The second, third, and attic floors of a building were given for that purpose, and \$1,500 were appropriated for equipping the apartments and for apparatus. Dr. E. W. Scripture, a pupil of Wundt in Leipzig, was called from Clark University to take charge. Orders for apparatus were sent off at once, and the preparation of the rooms went on all summer, so that the work of instruction and research began without a hitch on the first day of the term.

The laboratory consists of fifteen rooms, among which are the lecture room, seminary room, library, chemical, and battery rooms, apparatus room, isolated room, time room, general-research room, and workshop. The workshop contains a screw-cutting lathe and all tools that can be desired for the repair and manufacture of apparatus. A regular mechanic is at work here part of the time. This workshop, which is the most complete one ever put into a psychological laboratory, is regarded as the foundation of research and demonstration work. The plan followed in investing the funds has been to spend as little as possible for mere demonstration apparatus and to reserve nearly all for research work; nevertheless it is of supreme importance to have the lectures on psychology consist almost entirely of demonstrations. This difficulty has been completely solved by the workshop where the apparatus for demonstration is put together or manufactured with sufficient care for the purpose.

Three rooms, including the isolated room, are given over entirely to research. This isolated room is a small room built inside of another room; four springs of rubber and felt are the only points in which it comes in contact with the outer walls. The space between the walls is filled with sawdust as in an ice-box. The room is thus proof against sound and light, and affords an opportunity of making more accurate experiments on the mental condition than yet attempted.

A particularly new feature is the electrical communication between the rooms. It is nearly always necessary to separate the experimenter from the one experimented on; in order to avoid the large number of electrical wires necessary to connect the rooms separately a switchboard has been arranged similar to a telephone switchboard, to which sets of wires run from each room. But this one with fifty-six wires has been put in with the aid of a carpenter at about one-tenth the cost of a telephone board.

The following courses are given in the laboratory by Dr. Scripture: 1. A regular lecture course in experimental and physiological psychology of one hour per week, for seniors and graduates; the seniors alone recite on another day. 2. A laboratory course in experimental psychology for graduates, conducted on the seminary method by the men themselves. The object is not only to give a thorough knowledge of the psychological work in the laboratory, but to train the men in handling apparatus and in conducting lectures, thus providing a supply of instructors ready to take positions. This course has seventeen members, being exceeded in the graduate department only by Professor Ladd's philosophical courses. 3. Research work. It is the constant endeavor to awaken in the students the spirit of original investigation, this being what America most lacks in its educational life. Men are also encouraged on the principle that one learns most by doing. Last, not least, the fact is recognized that the amount of research done determines the standing of the laboratory in the scientific world. Already six original investigations of the highest class are under way; they include one on attention, in which

several improvements in apparatus and methods of experiment have already been made, one on the time of action and the fatigue of monocular accommodation, another on the rapidity of movement of the arm under the conditions present while writing, another on the reaction-time to tones as dependent on pitch, intensity, duration, etc.

The ample accommodations furnished by the fifteen rooms, the three months of energetic preparation during the summer, the high scientific stand taken in regard to research, the wise patronage of Professor Ladd and the enthusiasm of the young investigators lead us to hope that the first year will see us with a recognized standing, second only to Wundt's laboratory at Leipzig. Nevertheless, there are many difficulties to be overcome; the work of instruction really requires as full an equipment as a physical laboratory; moreover, research is the most expensive kind of work, thus putting a great strain on the appropriation. It would be a very great help if some one or more friends would undertake to support or aid some one of the researches, setting any desired amount as the limit beyond which the expenses are to be paid by the laboratory. We have already received considerable aid in our work: Professor Ladd has given the laboratory his valuable collection of charts and models and a microscope; a friend has donated \$75 for electric forks required in one of the researches; the B. F. Sturtevant Co. has sent a rotary blower; the Electric Gas Lighting Co. of Boston has sent a dozen Samson batteries; the Aluminium Brass and Bronze Co. of Bridgeport has made us a dozen discs twelve inches in diameter; the Boston Woven Hose and Rubber Co. has furnished some of their cross-stitched rubber belting; E. B. Meyrowitz has sent a set of test-cards, etc. More of such help would be thankfully received; at present we need a $\frac{1}{2}$ horse-power motor, a spark coil, etc. Possibly the day is not far distant when an endowment will be made for a separate building and a full equipment of apparatus.

HYBRIDISM EXEMPLIFIED IN THE GENUS COLAPTES.

BY SAMUEL N. RHOADS, ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

PERHAPS the most widespread and persistent tendency to hybridism that exists among the higher vertebrates to-day is to be found in this American genus of woodpeckers. The birds responsible for such a state of affairs are well known in their respective habitats as flickers, the eastern species being named the yellow-shafted flicker (*Colaptes auratus*), and its western congener, the red-shafted flicker (*Colaptes cafer*) by naturalists.

It early became known to explorers in the upper Missouri and Yellowstone regions of this country that where the habitats of these red- and yellow-shafted birds adjoin there often occurred individuals partaking the characters of both species. Audubon described in the appendix to his "North American Birds," a flicker from this region, with the yellow shafts and red nape of *auratus* combined with the red mustaches of *cafer*, as a distinct species, naming it *Picus ayresii*; but as more specimens were secured it became evident that these intermediate birds were not constant in character and their numbers were too great to be explained by any other theory than that they were the offspring of distinct species and were hybrids. Professor Baird enunciated this idea in 1858, classing for convenience all these nondescripts under the distinctive name of *Colaptes hybridus*, and asserting that their existence could be satisfactorily accounted for in no other way. The amount of material on which he based his theory, however, was small enough to warrant other theories, Mr. J. A. Allen attributing the existence of so-called "*hybridus*" to the "action of environment in accordance with certain laws of geographic variation," and later Mr. Ridgway suggested they were "remnants of a generalized form from which two incipient species have been differentiated." Dr. Coues, in 1884, thought the mixed birds might constitute "perhaps a hybrid and perhaps a transitional form," while Hargitt, in the British Museum Catalogue, makes the intermediates a race with the nominal status of a species under the Audubonian name of *ayresii*, admitting them to have been originally the result of a mixed union, showing possibly a "sign of reversion to remote ancestral plumage."

Last year (1891) Mr. J. A. Allen made the relationships of the whole genus the subject of an exhaustive study. The results of his examination are given in full in Vol. IV. of the Bulletin of the New York Museum of Natural History and being inaccessible to the general reader may be briefly summed as follows:—

1. Mixed birds show no stages of geographic variation comparable with those connecting species and sub-species. In the latter the transition is gradual, symmetrical, and correlated with change of environment, but in *Colaptes* the intergradation is irregular, often asymmetrical and without such correlation.

2. Very unlike birds have been found to breed together; diverse offspring being reared in the same nest by parents indifferently exhibiting normal or abnormal characters irrespective of sex. But so far typical *cafer* and *auratus* have not been found paired together.

3. On either side of the boundary of one thousand miles, along which their habitats adjoin, the influence of one species upon the other fades imperceptibly eastward and westward till it disappears.

4. The main area of hybrid distribution covers a belt of country two hundred miles wide and reaching north-westwardly from the Gulf-coast of Texas through Colorado, Wyoming, Montana, northern Idaho and Washington and the southern half of British Columbia to the Pacific, extending from southern Alaska to the mouth of the Columbia River. South and west of this the habitat of true *cafer* reaches from the Columbia to Tehuantepec, while north and east of it pure *auratus* ranges, over an area four times as great, from Florida to Hudson's Bay and from Labrador to Behring Sea.

5. Formerly, collections from certain parts of the far West, notably California and Nevada, were wanting in hybrids, but now they have become so common in some localities that thoroughbred birds are the exception. This favors the assumption that *auratus* is extending its range into the *cafer* region, and the absence of such an invasion of mixed individuals northward indicates that the transmigration is in the historic direction, from north to south.

This, with a few interpolations of my own sums up the evidence which has induced Mr. Allen and the majority of ornithologists to adopt Baird's theory to its fullest extent.

To this I wish to add a few supplementary remarks based on a collection of flickers made this year in British Columbia. As this series was chiefly collected in the breeding period we are relieved of the complications caused by the winter migration of Alaskan *auratus* into the region and can rely on the specimens as representing the domestic relations of the group.

Perhaps nowhere is the proportion of hybrids to pure-bred birds greater than on the Island of Vancouver. The dark, north-western form of *cafer* found here has so thoroughly assimilated the characters of *auratus* that *cafer* is the exception and *cafer-auratus* the rule. Nevertheless, pure *auratus* is very rare on the island. I have no specimens of it, but Mr. Fannin of the Victoria Museum has one, and Mr. Maynard of the same city states they are sometimes numerous in the fall. I am, however, from the absence of such specimens in collections, inclined to discount this statement, in the belief that they will prove to be of impure origin also. Indeed it is doubtful if there is much association, much less admixture, of thoroughbred individuals of the two species either with each other or with hybrids at the present day, many which appear pure, especially among the females, being of impure extraction.

Comparing the results of an examination of seventy skins, contained in the collections of the Academy of Natural Sciences of Philadelphia from debatable territory in the west and north-west, with the deductions given in Mr. Allen's admirable paper, the following general remarks seem in order:—

1. The prevailing tendency among hybrid flickers is in the direction of a symmetrical assumption of the characters of both species, examples of asymmetric coloration being rarely present and chiefly confined to the females.

2. A much larger percentage of male than female birds show mixed parentage. This indicates either that hybridism in this case results in an overproduction of males or a disparity in the